

FRESHWATER TRICLADS (TURBELLARIA) OF NORTH  
AMERICA. XIII. *PHAGOCATA HAMPTONAE*,  
NEW SPECIES, FROM NEVADA

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*Abstract.*—A new species of the planarian genus *Phagocata*, *P. hamptonae*, is described. It differs from all other North American species of the genus by having 4 to 11 eyes in the usual position. In the copulatory apparatus, the structure of the penis deviates from the general plan by having a wide ejaculatory duct filled with an eosinophilic secretion. The species forms spermatophores that are inserted into the bursa of the copulating partner.

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In an extensive field study of the freshwater triclads of the Lake Tahoe basin and the surrounding area, Dr. Anne M. Hampton discovered a white planarian with more than one pair of eyes, that she recognized as being a new taxon. She kindly sent me a number of live specimens for a more detailed study. Some of the worms were sexually mature.

*Phagocata hamptonae*, new species

*Type-material.*—All type-specimens are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. Holotype, set of sagittal sections on 3 slides (USNM 68009); paratypes, 5 sets of sagittal sections on 3 slides each (USNM 68010-68014) and one set of transverse sections of posterior part of body on 3 slides (USNM 68015).

*External features* (Fig. 1).—The species is unpigmented, white, and at first glance resembles the eastern *Phagocata morgani* (Stevens and Boring). Mature specimens reach a length of 11 mm and a width of 1.3 mm. The anterior end is truncate, with a straight or somewhat wavy frontal margin (slightly convex in the center), changing somewhat during gliding locomotion, and with rounded lateral corners. Behind the anterior end, a slight narrowing or "neck" may be seen in the gliding animal. The body soon reaches its maximum width, the lateral margins running parallel in the greater part of the body length, converging in the last fifth of the body, and meeting at the bluntly pointed posterior end.

The most characteristic feature of the species is the plurality of the eyes. While most species of *Phagocata* have only one pair of eyes or are blind, *P. hamptonae* has a small but variable number of eyes (Fig. 1c). Dr. Hampton, who analyzed 37 specimens, found their number to vary between 4 and 11, the mean number being 6, arranged generally in two longitudinal rows separated by about one-fifth the transverse diameter of the head. The eyes are rather small, of about equal size, but fully functional, each equipped with a well-developed pigment cup.

The pharynx measures about 1/5 the body length, its root being inserted anterior to the middle of the body in mature specimens. The intestine is amply ramified, which makes it difficult to count the branches of the intestinal trunks. By feeding some specimens a mixture of beef-liver tissue and carbon powder and later ex-

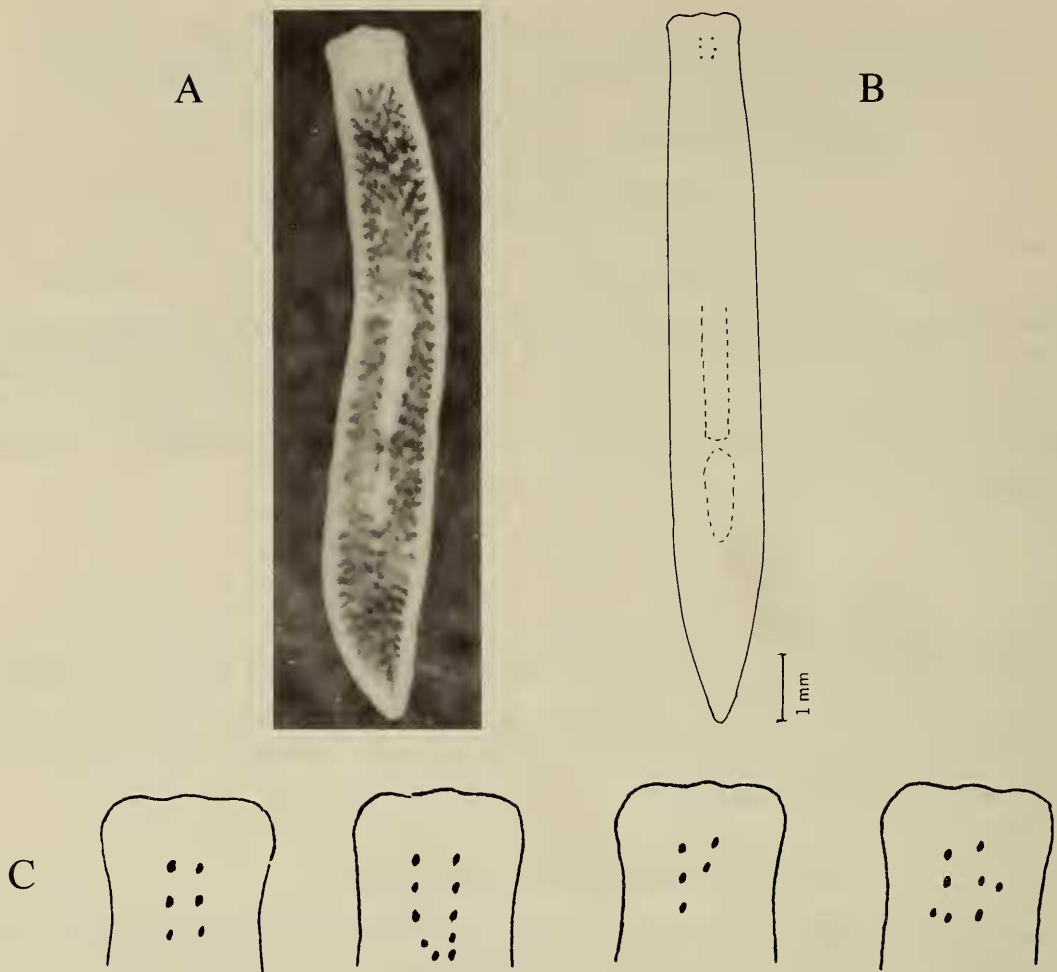


Fig. 1. *Phagocata hamptonae*: A, Photograph of living specimen after ingestion of a mixture of beef-liver tissue and carbon powder to show the intestine,  $\times 7.5$ ; B, Outline drawing with indication of eyes, pharynx, and copulatory apparatus; C, Arrangement of eyes, redrawn from sketches prepared by A. M. Hampton.

amining them under slight compression, the approximate number of branches could be established: 4–6 heavily ramified branches on either side of the anterior trunk; the two posterior trunks each bear about 14–19 less ramified lateral branches and a considerable number of short medial diverticula. Postpharyngeal anastomoses between the two trunks may occur.

*Anatomy.*—The anterior end shows no special structures (glands or muscles) that could be interpreted as corresponding to an adhesive organ. The zone of eosinophilic adhesive glands, that runs along the ventral side of the body margins, is interrupted in the central area of the frontal margin, where there is a field of infranucleate ciliated epithelium, apparently a sensory organ. The pharynx has the normal structure characteristic of the Planariidae, its internal muscular zone consisting of a thick layer of circular fibers surrounding the pharyngeal canal, followed by a layer of longitudinal muscles.

The two ovaries or germaria are situated on the medial side of each ventral nerve cord at the level of the first lateral branches of the intestine. Each ovary is accompanied by a group of cells about the size of the ovary, situated anterior to it. Such cell accumulations adjoining the ovaria are widely distributed in tri-

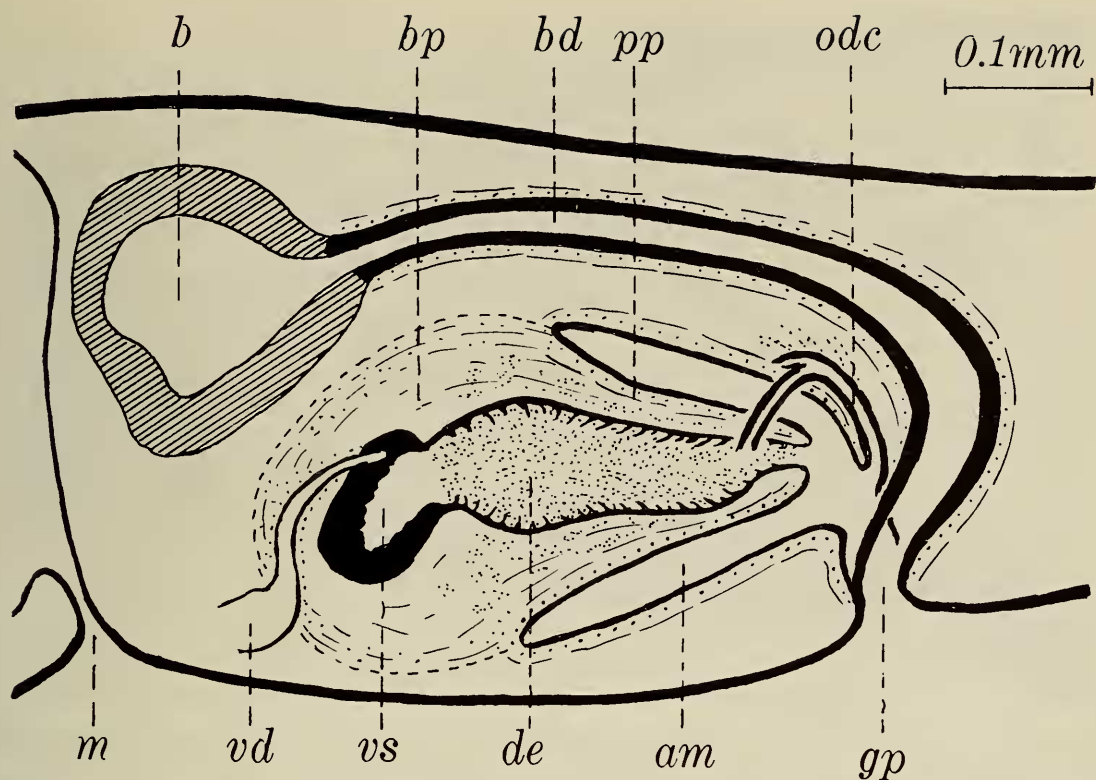


Fig. 2. *Phagocata hamptonae*, semidiagrammatic view of copulatory apparatus in sagittal section: *am*, male atrium; *b*, copulatory bursa; *bd*, bursal duct; *bp*, penis bulb; *de*, ejaculatory duct; *gp*, gonopore; *m*, mouth; *odc*, common oviduct; *pp*, penis papilla; *vd*, vas deferens; *vs*, seminal vesicle.

clads and are usually termed “parovaria.” In *P. hamptonae* these cells correspond entirely in size, stainability, and cytoplasmic inclusions (yolk granules) to the cells of the vitellaria, a fact that confirms the often expressed assumption that the parovaria have a genetic, if not always functional, relation to the yolk glands.

The numerous testicles are of moderate size, usually measuring less than half the dorsoventral diameter of the body. They are predominantly ventral and are arranged in longitudinal rows beginning a short distance posterior to the ovaries and extending to almost the hind end of the body. The two sperm ducts or vasa deferentia run along the ventral nerve cords medial to the oviducts. In the region of the pharynx they expand to form the spermiductal vesicles or “false seminal vesicles” which, filled with sperm, proceed posteriorly to their entrance into the penis bulb.

The copulatory apparatus (Fig. 2) closely adjoins the pharyngeal pouch. The genital atrium is confined to the male atrium (*am*), since the bursal duct (*bd*) proceeds directly to the gonopore (*gp*) without entering a separate atrial compartment. The penis consists of a relatively large bulb (*bp*) and a conical papilla (*pp*). The bulb has its musculature developed principally near its periphery, while its central part is remarkably devoid of muscle fibers. The lumen of the penis is clearly divided into two sections. An anterior cavity, the seminal vesicle (*vs*), located in the bulb, is lined with an epithelium of cuboidal, apparently apocrine, cells, the secretions of which must have dissolved during the procedures used in preparing the sections, so that the cells look empty (see Fig. 3). The posterior part (*de*) of the lumen is a rather wide, elongated cavity, separated from the



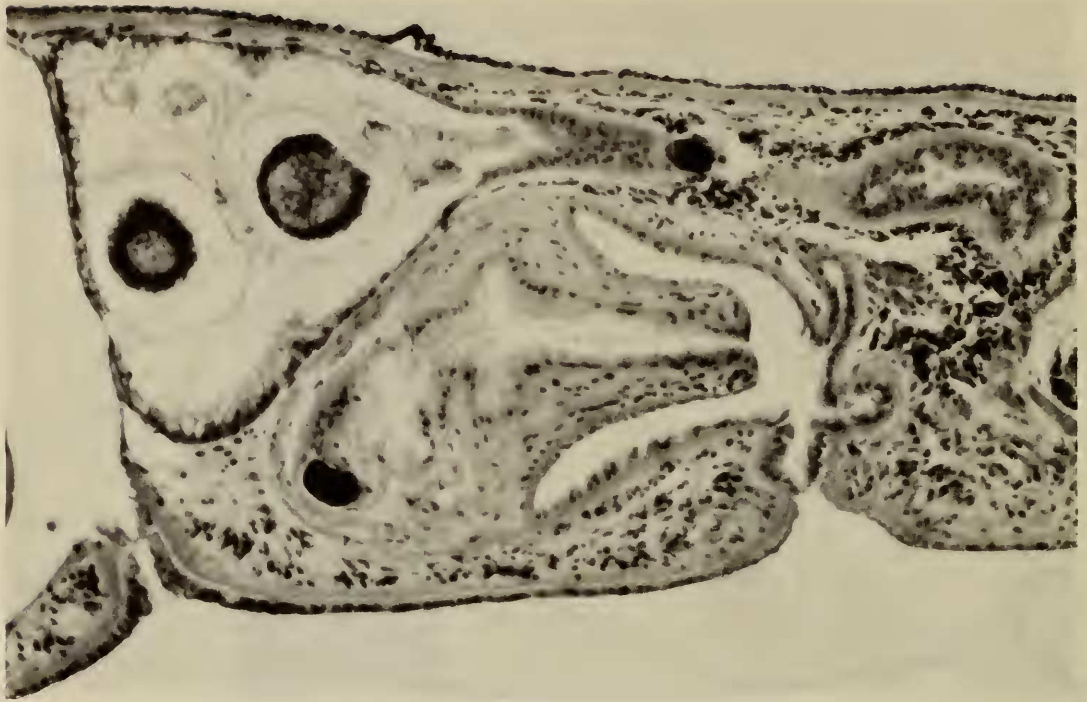


Fig. 3. *Phagocata hamptonae*, photomicrograph of a sagittal section through the copulatory complex of a specimen that has two spermatophores in the copulatory bursa,  $\times 120$ .

seminal vesicle by a slight constriction and extending from the penis bulb to the tip of the papilla, tapering gradually in its posterior portion. It is almost completely filled with strands of a granular, slightly eosinophilic secretion, the origin of which is not quite clear. It may be in part produced by the epithelial cells lining the cavity, but traces of apparently the same secretion are seen also in the parenchymal part of the penis papilla, which would hint at gland ducts entering from the mesenchyme surrounding the penis bulb. This posterior part of the penis lumen corresponds by its location to the ejaculatory duct of related species, although it may have a different function, possibly related to the production of spermatophores. The two sperm ducts or vasa deferentia (*vd*) enter the penis bulb ventrolaterally, turn upward, and open into the seminal vesicle separately.

The two oviducts or ovovitelloducts run along the dorsal side of the ventral nerve cords up to the level of the male atrium. There they turn dorsally, approach the midline, and unite in the space between the atrium and the bursal duct. The common oviduct (*odc*) thus formed proceeds posteroventrally in a short curve along the atrial wall and opens into the posterior part of the atrium. The paired oviducts, after they have left the nerve cords, and the upper part of the common oviduct receive the highly eosinophilic shell glands.

The copulatory bursa (*b*) is of variable size and shape. In some of the specimens it contained remnants of spermatophores (see Fig. 3). Spermatophores were also visible in some living specimens as glittering spherules shining through the transparent body wall.

The bursal stalk or duct (*bd*) runs from the bursa posteriorly above the penis and atrium, then curves ventrally, slightly increasing in diameter, and opens at the gonopore (*gp*) to the left of the outlet of the male atrium. No differentiated

end part or vagina is developed and the duct is histologically uniform throughout. Its musculature consists of a subepithelial layer of circular fibers, surrounded by a layer of longitudinal muscles.

All epithelia of the copulatory complex are nucleate, including the common oviduct, while the paired oviducts show an infranucleate epithelium.

*Distribution and ecology.*—*Phagocata hamptonae* was collected by Dr. Anne M. Hampton in an irrigation ditch 400 m east of the ranch house on the Gene Scossa Ranch, Gardnerville, Douglas County, Nevada, on 5 April 1981 (water temperature, 15°C, pH 7.5) and 5 July 1981. Dr. Hampton sent me samples from both collections, containing some sexually mature and some immature specimens. The worms were placed in cultures kept at 14°C. They readily accepted beef liver as food.

*Taxonomic position.*—The genus *Phagocata* is admittedly a very heterogeneous genus, distributed widely in the Northern Hemisphere in both Eurasia and North America (see also discussion by Ball and Gourbault 1975:11–13). The members of the genus conform in the basic structure of the copulatory apparatus, though they may differ in many other characters that are of taxonomic significance. In some species the testicular zone extends to the tail end, in others only to the level of the mouth; some are pigmented, others white; they generally have one pair of eyes, but some are blind, and the present species has multiple eyes (as does *P. uenoi* Okugawa from Manchukuo, see Okugawa 1939:157). It must be stressed that the eyes are completely formed eyes with no intergrades between functional eyes and apparently nonfunctional pigment clumps, such as are seen in *P. morgani polycelis* Kenk (1935:103), *Dendrocoelopsis americana* (Hyman) (Kenk 1973:14) and some species of *Dendrocoelum*. The structure of the penis may vary in the genus within wide limits even in species that are closely related both morphologically and zoogeographically. Within certain geographic regions we may find groups of species that are undoubtedly monophyletic and could be gathered into separate subgenera or even genera. *Phagocata hamptonae* has the zone of testes approaching the posterior end of the body, a character it shares with nine of the North American species of the genus. On the other hand, *P. morgani* (Stevens and Boring), *P. bursaperforata* Darlington, *P. bulbosa* Kenk, *P. angusta* Kenk, and *P. holleri* Kenk have no testes behind the copulatory apparatus. *Phagocata hamptonae* is monopharyngeal as are all the other North American species except *P. gracilis* (Haldeman), *P. woodworthi* Hyman, and *P. nordeni* Kenk. The new species may well deserve to be placed in a separate subgenus, principally on account of the aberrant morphology of its penis. This should be done, however, within the framework of a reexamination of the entire genus.

The species is named in honor of its collector, Dr. Anne Marie Hampton of Tahoe Paradise, California.

#### Acknowledgments

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